

THE BEHAVIORAL RESPONSE OF A RED-TAILED HAWK TO MILITARY TRAINING ACTIVITY

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Abstract — From 13 August through 9 November 1982, we systematically radio-tracked an adult male Red-tailed Hawk (*Buteo jamaicensis*) on the Fort Carson Military Reservation in east-central Colorado. Harmonic mean analysis of telemetry data indicated that the bird shifted its center of activity away from areas of high human activity, but returned to those areas after human activity ceased.

Both short and long term effects of human disturbance on birds of prey have been the subject of recent investigation. Changes in density and species composition (Voous 1977; Craighead and Mindell 1981) and in population size and nesting distribution (Swenson 1979) have all been attributed to increased human activity. Nesting failures (Boeker and Ray 1971), lowered nesting success (Wiley 1975), and impacts on wintering distribution and behavior (Stalmaster and Newman 1978) have also occurred as a result of increased human activity. Activities of short duration, however, have not had

as great an impact. Helicopter overflights (Platt 1977), frequent low level jet overflights (Snyder et al. 1978), and jet flights with associated sonic booms (Ellis 1977) did not appear to limit productivity or adversely affect behavior in a variety of North American raptors. Jackson and McDaniel (1977) even observed a Northern Harrier (*Circus cyaneus*) they believed exploited military activity to increase hunting success. Here, we report on behavioral responses of an adult Red-tailed Hawk (*Buteo jamaicensis*) to periodic military training activity.

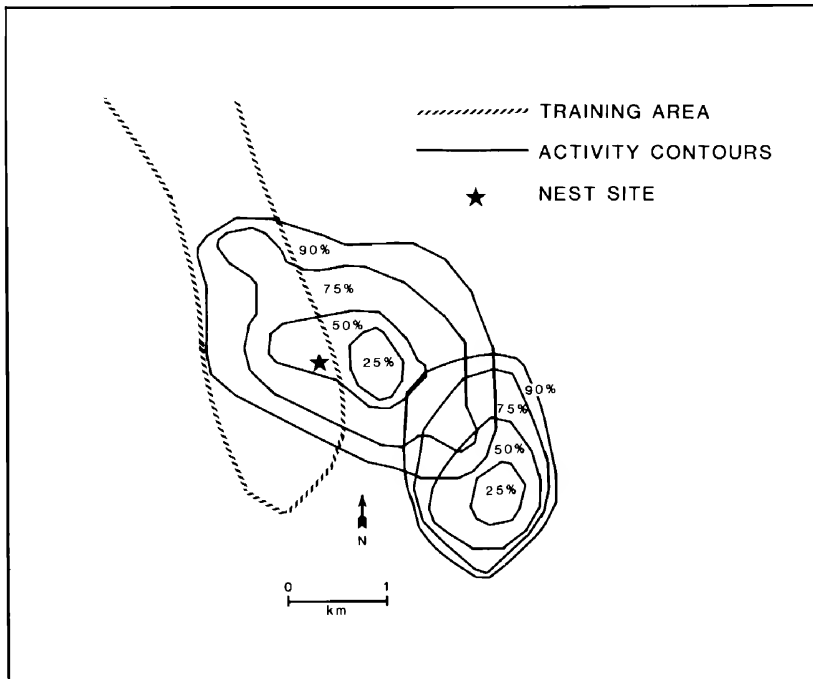


Figure 1. Activity areas of an adult male Red-tailed Hawk on the Fort Carson Military Reservation, Colorado, from 13 August through 9 November 1982. Activity contours represent isopleths that enclose 25, 50, 75 and 90% of all relocations. The larger area was calculated from 74 relocations obtained when there was no military activity in the training area, and the smaller area was calculated from 31 relocations obtained when the training area was used for tank maneuvers and heavy weapons firing.

Table 1. Tracking periods on an adult male Red-tailed Hawk at Fort Carson Military Reservation, Colorado, from 13 August to 9 November 1982.

| DATE | NUMBER OF RELOCATIONS | HOURS TRACKED | MILITARY ACTIVITY ¹ |
|--------------|-----------------------|---------------|--------------------------------|
| 13 August | 9 | 4.0 | none |
| 25 August | 6 | 3.0 | none |
| 26 August | 3 | 1.0 | none |
| 31 August | 9 | 4.0 | present |
| 13 September | 7 | 3.0 | none |
| 14 September | 8 | 3.5 | none |
| 20 September | 9 | 4.0 | none |
| 26 September | 7 | 3.5 | none |
| 3 October | 8 | 3.5 | none |
| 12 October | 9 | 4.0 | present |
| 20 October | 8 | 3.5 | none |
| 27 October | 7 | 3.0 | none |
| 2 November | 2 | 2.0 | none |
| 5 November | 5 | 2.0 | present |
| 9 November | 8 | 3.5 | present |
| Totals | 105 | 47.5 | |

¹Refers to the activity level in the tank training area (see text). Military personnel and equipment were either training in ("present") or absent from ("none") the area.

STUDY AREA AND METHODS

The Fort Carson Military Reservation is in east-central Colorado along the eastern edge of the Front Range south of Colorado Springs, Colorado. Climate there is classified as dry continental and major plant associations include pinyon pine (*Pinus edulis*) - juniper (*Juniperus monosperma*), blue grama (*Bouteloua gracilis*) - western wheatgrass (*Agropyron smithii*), and cottonwood (*Populus* spp.) - willow (*Salix* spp.) (Harrington 1954; U.S. Army 1980). Elevation is approximately 1700 m and topography is characterized by moderately rolling high plains whose surfaces are often interrupted by scattered rocky escarpments and low foothills. The study area is used by the U.S. Army for the training, housing and support of the 4th Infantry Division (Mechanized).

On 31 May 1982, we captured an adult male (sex was determined by behavior and relative size) Red-tailed Hawk and fitted it with a radio transmitter attached as a backpack (Smith and Gilbert 1981). The bird's nest was situated on a cliff immediately adjacent to a military training area (Fig. 1) in a 1-3 km wide valley. One young fledged from the nest in late June. The training area was used periodically during the study for tank maneuvers and heavy artillery firing. When in use, approximately 50 tanks were in the area and periodic firing occurred at stationary and moving targets. Vehicles and military personnel used the entire valley, and a major vehicle trail passed 250 m in front of the nest cliff. The primary firing area was 500 m south of the nest site and tanks fired from this area past the nest cliff at targets either in the valley or in an impact area 11 km to the north.

We monitored the bird for 47.5 hrs between 13 August and 9 November 1982. Relocations were obtained every 30 min during 2 to 4 hr tracking periods and plotted on 1:24,000 U.S. Geol. Survey topographic maps. Tracking was conducted from a vehicle and on foot. Military activity was assessed visually throughout each tracking period and categorized on the basis of presence or absence of military personnel and equipment. Four tracking periods occurred when the training area was being used by the military, and 11 periods occurred when it was not (Table 1).

We calculated minimum perimeter polygons (Mohr 1947; Jennrich and Turner 1969) for periods during military activity and for periods when the training area was not in use. Harmonic mean measures of activity areas (Dixon and Chapman 1980) were used to assess behavioral responses to military activity. Arbitrary 10 x 10 grids were selected for calculating harmonic means in a computer program developed by J.R. Cary at the University of Wisconsin.

RESULTS AND DISCUSSION

During periods when there was no military activity in the tank training area, the adult male Red-tailed Hawk included much of the training area within its activity area (Fig. 1). Twenty-five of 74 (34%) total relocations were obtained within the boundaries of the training area and 37% of the 90%

harmonic mean activity area was included in the training area. In contrast, during periods of military activity, none of the 31 relocations obtained were inside the training area and the bird shifted its center of activity approximately 1.75 km southeast (Fig. 1). During these periods, the bird was never located west of the ridge which defined the east boundary of the training area. This north-south oriented ridge supported the nest and visually isolated the training area from the bird's southeast activity area.

Minimum perimeter polygons also showed a shift to the southeast during periods of military training. The minimum perimeter polygon calculated for periods of army activity defined an area of 219 ha in the southeast portion of the bird's range. Thirty percent (75 ha) of this area was outside of the minimum perimeter polygon (790 ha) defined by relocations obtained when there was no military activity in the training area. Harmonic mean analysis of all relocations obtained for the bird (combining data collected during periods of army activity and periods of no activity) showed the same 2 activity centers as those generated when data were separated on the basis of military activity.

The adult male hawk apparently altered its behavior to accommodate periods of military activity. It was never relocated in the training area when military personnel and equipment were present, although it returned to the training area after training ceased. The bird's mate was not marked, and we did not determine whether it exhibited similar behavior. Since the pair nested within the confines of the training area, and since most Red-tailed Hawks are year-round residents on the study area (Andersen 1984), the male had probably been exposed previously to periods of intensive military activity. We do not know how frequently this short term displacement/relocation behavior may occur in Red-tailed Hawks or whether it is also exhibited by other birds of prey.

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LITERATURE CITED

- ANDERSEN, D.E. 1984. Military training and the ecology of raptor populations at Fort Carson, Colorado. M.S. Thesis, Univ. of Wisconsin, Madison.
- BOEKER, E.L. AND T.D. RAY. 1971. Golden Eagle population studies in the southwest. *Condor* 73:463-467.
- CRAIGHEAD, F.C. JR. AND D.P. MINDELL. 1981. Nesting raptors in western Wyoming, 1947 and 1975. *J. Wildl. Manage.* 45:865-872.
- DIXON, K.R. AND J.A. CHAPMAN. 1980. Harmonic mean measures of animal activity areas. *Ecology* 61:1040-1044.
- ELLIS, D.H. 1981. Responses of raptorial birds to low level military jets and sonic booms. Inst. for Raptor Studies. Unpubl. report.
- HARRINGTON, H.D. 1954. Manual of the plants of Colorado. Sage Books, Denver.
- JACKSON, J.A. AND T.H. MCDANIEL. 1977. Opportunistic hunting of a Marsh Hawk on a bombing range. *Raptor Res.* 11:86.
- JENNIRICH, R.I. AND F.B. TURNER. 1969. Measurements of noncircular home range. *J. Theor. Biol.* 22:227-237.
- MOHR, C.O. 1947. Table of equivalent populations of North American small mammals. *Am. Midl. Nat.* 37:233-249.
- PLATT, J.B. 1977. The breeding behavior of wild and captive Gyrfalcons in relation to their environment and human disturbance. Ph.D. Thesis, Cornell Univ. Ithaca, N.Y.
- SMITH, D.G. AND R. GILBERT. 1981. Backpack radio transmitter attachment success in Screech Owls (*Otus asio*). *N. Am. Bird Band.* 6:142-143.
- SNYDER, N.F.R., H.W. KALE II AND P.W. SYKES, JR. 1978. An evaluation of some potential impacts of the proposed Dade county training jetport on the endangered Everglade Kite. Patuxent Wildl. Res. Cent., U.S.F. & W.S.
- STALMASTER, M.V. AND J.R. NEWMAN. 1978. Behavioral responses of wintering Bald Eagles to human activity. *J. Wildl. Manage.* 42:506-513.
- SWENSON, J.E. 1979. Factors affecting status and reproduction of Ospreys in Yellowstone National Park. *J. Wildl. Manage.* 43:595-601.
- U.S. DEPT. OF ARMY. 1980. Draft: Environmental impact statement for the continuing operation of Fort Carson. Fort Carson, Colorado.
- VOOUS, K.H. 1977. Three lines of thought for consideration and eventual action. Pp. 343-347, *In Proc. Int. Council. for Bird Preserv. World Conf. on Birds of Prey, Vienna, Austria 1975.*
- WILEY, J.W. 1975. The nesting and reproductive success of Red-tailed and Red-shouldered Hawks in Orange County, California: 1973. *Condor* 77:133-139.

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